mistake, if there be a mistake, is surely on the right side. A solid text is far better than a slim one, in such a book. Probably few of his readers will find it necessary to go beyond his text for the information which they are seeking. And this is a distinct advantage in the case of a text-book which we hope, and believe, will have extended use among teachers.

Professor Milham's desire to present the current views of meteorologists leads him in some cases to outline several theories (as, *e. g.,* in the case of the theories of extra-tropical cyclones). He gives the arguments *pro* and *con* very clearly and succinctly, but the student may perhaps wish that something more definite had been given him. Most students of elementary science do not like to argue things out for themselves. What they want is a definite statement which they may take as authoritative. This is not a very encouraging frame of mind, but it is very common. Again, in a few cases, our author does not seem to us to have given, with sufficient clearness, the generally recognized explanation of the phenomenon which he is discussing, *e. g.,* in connection with the relation between isobaric surfaces and isobaric lines, the diurnal variation in wind direction, and the formation of the tornado funnel cloud. Yet we have no hesitation in saying that Professor Milham has, on the whole, avoided giving too great detail on the one hand, and too incomplete an outline on the other. The discussion of the deflective effect of the earth's rotation and of its application to the circumpolar whirl, and of the general circulation (surface and upper), will perhaps strike others besides the reviewer as being among the less effective portions of the text, while the sections on weather prediction are admirably done. There is an excellent, clear, and complete account of weather forecasting, which will be found extremely useful. A generous supply of charts, including several carefully selected illustrative weather maps, adds greatly to the value of the book. A few of the illustrations are not always as clear as could be wished, as, for example, the figure of a thunderstorm (p. 324), of the distribution of the meteorological elements around tropical and extra-tropical cyclones, and around anticyclones (pp. 268, 284, 295).

The volume itself is a singularly clear and effective presentation of the present status of meteorological science, in a form which renders it extremely useful for teaching. We feel sure that Professor Milham has given us a text which will contribute greatly to the advance of meteorological knowledge in this country. R. DEC. WARD.

The Effect of Topography and Isostatic Compensation upon the Intensity of Gravity. By John F. Hayford and William Bowie. Special Publication No. 10, Coast and Geodetic Survey, 1912. 132 pp. Maps, ills., index. 11½ x 9.

The introduction of isostasy in the determination of the figure and size of the earth from observed deflections of the vertical resulted in a marked increase in the accuracy of the values deduced. It was logical that isostasy should be considered in the reduction of gravity observations in order that a corresponding increase in accuracy of the shape of the earth might be obtained from these data.

A preliminary report on the reduction of fifty-six gravity stations in the United States, by the new method, was made to the International Geodetic Association at London and Cambridge in 1909 by Hayford. The present publication is a complete report on the reduction of eighty-nine gravity stations in the United States.

By the new method a correction is applied at each station for the attraction of the topography of the whole earth and also a correction for the isostatic compensation of the topography in addition to the correction for the height of the station above sea-level. The compensation is assumed to be complete and uniformly distributed from the surface to a depth of 113.7 kilometers. This was the most probable limiting depth as determined by the first investigation of the figure of the earth and isostasy from measurements in the United States. The better value of 120 kilometers, obtained from the second investigation of the figure of the earth and isostasy, was not available at the time the tables were computed for the gravity reductions.

The methods used in applying the effect of the topography and its compensation are fully described and the necessary working tables are given. In

fact, all the data are given that are necessary for making reductions at any gravity station in the world.

The procedure at each of the gravity stations was to compute the theoretical gravity for the latitude of the station in question by the Helmert formula, correct this for the elevation of the station above sea level and then apply the correction for the topography of the world and its compensation. The resulting theoretical value is then compared with the actually observed value of gravity at the station. The difference between the computed and observed values is the anomaly which indicates a departure at that station from the assumed density of the earth's surface and of the computed excesses and defects of density in the crust to the depth of compensation.

A comparison is made of the new method anomalies in size and sign, with the anomalies given by the free air and Bouguer methods and the result is in practically every case in favor of the new method.

The eighty-nine stations in the United States were arranged in groups with reference to their relation to topography. The groups are: 16 coast stations; 18 stations near the coast (within 325 kilometers); 27 continental stations not in mountainous regions; 16 stations in mountainous regions, below the general level; and 12 stations in mountainous regions, above the general level. The mean without regard to sign of the anomalies at eighty-seven stations (two stations not considered) is .017 dyne or centimeter. For the five groups mentioned above the corresponding means are .017, .020, .018, .012, and .014 dyne, of which no one is much above the general mean of all.

The means with regard to sign for the five groups are: —.004, +.002, +.002, —.002, and +.003 dyne. The general conclusion from the examination is that the anomalies by the new method show no relation to the topography either in sign or average magnitude. It is shown on the other hand that there are decided relations between the anomalies by the two older methods of reduction and topography.

It was found that there appears to be a relation between the surface geologic formation and the size and sign of the new method anomalies. The mean of the anomalies at seven stations on Pre-Cambrian formation is +.019 dyne, with regard to sign, and .026 dyne, without regard to sign. This indicates an excess of material in the crust in the vicinity of these stations. The means with and without regard to sign of the anomalies at 20 stations in the Cenozoic are —.011 and .021 dyne, respectively. This appears to indicate a deficiency in mass in the crust at these stations. It is shown that these anomalies are probably caused by erroneous assumptions as to the density of the surface materials and also to a departure from a state of complete isostasy.

The mean without regard to sign of the new-method anomalies at the eighty-nine stations in the United States is only 0.017 dyne. An anomaly of +0.017 dyne would be produced by an excess of mass corresponding in amount to a stratum about 570 feet thick of density 2.67 (the mean surface density of the earth) with the station at the center of one surface of the disk and the disk of indefinite extent. An anomaly of —0.017 dyne would be produced similarly by a deficiency of mass corresponding to a stratum about 570 feet thick. The gravity observations indicate, therefore, that the isostatic compensation is everywhere so nearly complete that the excesses and deficiencies of mass above the limiting depth of compensation correspond upon an average to a stratum only 570 feet thick. The average elevation of the surface of the ground in the United States is about 2,500 feet, more than four times 570 feet.

The evidence furnished by the new method gravity anomalies in regard to the location and extent of the continuous areas of excess or deficiency of mass in the United States, that is, of under-compensation or of over-compensation, confirms and supplements that given by the observed deflections of the vertical previously considered and published by the Coast and Geodetic Survey in the second publication on the Figure of the Earth and Isostasy. (Written by W. Bowie and reprinted from the *Journal of the Washington Academy of Science,* April 4, 1912.)